

CLAIMS

What is claimed is:

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1. A push-pin assembly ⁵⁴⁶ for use with a positioning arm of a disk drive servo writer, said push-pin assembly comprising:

- (a) a contact ⁵⁵⁰ pin comprising a shaft ⁵⁵² and a contact ⁵⁵⁴ head, wherein said contact head comprises an actuator arm ^{top} facing surface engageable with a disk drive actuator arm assembly;
- (b) a body ⁵⁶⁰ interconnectable with the positioning arm, said body comprising a contact pin ⁵⁶² receptacle, wherein at least a lower portion of said shaft of said contact pin is disposed in said contact pin receptacle such that said body is disposed about a perimeter of said lower portion of said contact pin, and wherein said contact head is disposed beyond an end of said body; and
- (c) a vibration damper ^{570A} disposed between at least a portion of said lower portion of said shaft of said contact pin and said body, wherein an entirety of said shaft of said contact pin and said body are disposed in spaced relation.

2. A push-pin assembly, as claimed in Claim 1, wherein said shaft of said contact pin further comprises a protrusion ⁵⁵⁷ disposed toward an end of said shaft opposite said contact head, wherein said vibration damper is positioned about a portion of said shaft which is disposed between said protrusion and said contact head.

3. A push-pin assembly, as claimed in Claim 2, wherein said protrusion is annular.

4. A push-pin assembly, as claimed in Claim 2, wherein said protrusion comprises a plurality of radially spaced protrusion segments. ^{11C}

5. A push-pin assembly, as claimed in Claim 2, wherein said protrusion engages an end of said vibration damper.

6. A push-pin assembly, as claimed in Claim 1, wherein said shaft further comprises a protrusion, wherein said protrusion is disposed between said contact head and said vibration damper. ⁵⁵⁸

7. A push-pin assembly, as claimed in Claim 6, wherein said protrusion interfaces with an end of said vibration damper, and is free from contact with said body. ^{571A}

8. A push-pin assembly, as claimed in Claim 6, wherein said protrusion comprises a plurality of radially spaced protrusion segments.

9. A push-pin assembly, as claimed in Claim 6, wherein said protrusion is annular.

10. A push-pin assembly, as claimed in Claim 1, wherein said contact pin receptacle of said body is substantially annular, wherein said at least said lower portion of said shaft of said contact pin is substantially cylindrical, and wherein said at least said lower portion of said shaft of said contact pin is concentrically disposed in said contact pin receptacle of said body.

11. A push-pin assembly, as claimed in Claim 1, further comprising means for maintaining said contact pin in a set position along a longitudinal extent of said shaft of said contact pin and relative to said body.

protrusion

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12. A push-pin assembly, as claimed in Claim 1, wherein said vibration damper is annular.

13. A push-pin assembly, as claimed in Claim 1, wherein said vibration damper comprises a plurality of radially spaced vibration damper segments.

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14. A push-pin assembly, as claimed in Claim 1, wherein said vibration damper is formed from a material selected from the group consisting of urethane materials, polyurethane materials, piezoelectric materials, and combinations thereof.

15. A push-pin assembly, as claimed in Claim 1, wherein a portion of said shaft of said contact pin extends beyond an end of said vibration damper within said contact pin receptacle.

16. A push-pin assembly, as claimed in Claim 1, wherein said contact pin receptacle comprises a first longitudinal receptacle section and a second longitudinal receptacle section, wherein said first longitudinal receptacle section has a larger effective diameter than said second longitudinal receptacle section such that a first spacing between a first wall of said first longitudinal receptacle section and said shaft is greater than a second spacing between a second wall of said second longitudinal receptacle section and said shaft.

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17. A push-pin assembly, as claimed in Claim 16, wherein said vibration damper is disposed in said first longitudinal receptacle section, wherein a length of said vibration damper is less than a length of said first longitudinal receptacle section.

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18. A push-pin assembly, as claimed in Claim 16, wherein said shaft extends within both said first and second longitudinal receptacle sections.

19. A push-pin assembly, as claimed in Claim 16, wherein said vibration damper comprises first and second longitudinally spaced vibration dampers, wherein said first vibration damper is disposed within said first longitudinal receptacle section, and wherein said second longitudinal receptacle section is disposed between said first longitudinal receptacle section and said second vibration damper.

20. A push-pin assembly, as claimed in Claim 1, wherein said vibration damper comprises first and second vibration dampers which are spaced along a longitudinal extent of said shaft of said contact pin.

21. A push-pin assembly, as claimed in Claim 20, wherein said first vibration damper has a modulus of elasticity which is less than, substantially equal to, or greater than a modulus of elasticity of said second vibration damper.

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22. A push-pin assembly, as claimed in Claim 20, wherein said first vibration damper comprises a different material than that of said second vibration damper.

23. A push-pin assembly, as claimed in Claim 20, wherein said first vibration damper and said second vibration damper comprise the same material.

24. A push-pin assembly, as claimed in Claim 20, wherein at least one of said first vibration damper and said second vibration damper comprises a piezoelectric material.

25. A push-pin assembly, as claimed in Claim 24, wherein said push-pin assembly further comprises means for providing an electrical signal to said piezoelectric material to change at least one physical property of said piezoelectric material.

26. A push-pin assembly, as claimed in Claim 20, wherein said second vibration damper is disposed about and longitudinally extends beyond an end of said shaft opposite said contact head.

27. A push-pin assembly, as claimed in Claim 1, wherein said vibration damper is an electrical insulator.

28. A push-pin assembly, as claimed in Claim 27, wherein said lower portion of said shaft comprises a first conductor of a capacitive sensor, said body comprises a second conductor of said capacitive sensor, and a first open area comprises a dielectric of said

capacitive sensor, wherein said first open area is devoid of said vibration damper and is defined between said lower portion of said shaft and said body.


29. A push-pin assembly, as claimed in Claim 1, wherein said push-pin assembly further comprises a means for monitoring a position of said shaft of said contact pin relative to said body.

30. A push-pin assembly, as claimed in Claim 29, wherein said means for monitoring comprises a switch, wherein said lower portion of said shaft is a first switch contact element, and a receptacle wall of said body is a second switch contact element.

31. A push-pin assembly, as claimed in Claim 29, wherein said means for monitoring a position of said shaft comprises a capacitive sensor, wherein said lower portion of said shaft comprises a first conductor of said capacitive sensor, said body comprises a second conductor of said capacitive sensor, and a first open area comprises a dielectric of said capacitive sensor, wherein said first open area is devoid of said vibration damper and is defined between said lower portion of said shaft and said body, such that failure of said vibration damper results in said lower portion of said shaft being repositioned relative to said body, and thus causing a change in capacitance.

32. ^B A push-pin assembly for use with a positioning arm of a disk drive servo writer, said push-pin assembly comprising:

(a) a contact pin comprising a ⁵⁰⁶shaft and a ^{507, 522}contact head, wherein said contact head comprises an actuator arm facing surface engageable with a disk drive actuator arm assembly;

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 (b) a body comprising a receptacle wall defining a contact pin receptacle, wherein at least a lower portion of said shaft of said contact pin is disposed in said contact pin receptacle such that at least part of said receptacle wall of said body is disposed about a perimeter of said lower portion of said contact pin, and wherein said contact head is disposed beyond an end of said body; and

(c) a vibration damper disposed between at least a first longitudinal segment of said lower portion of said shaft of said contact pin and said receptacle wall of said body, wherein an open area separates a second longitudinal segment of said lower portion of said shaft from said receptacle wall of said body.

33. A push-pin assembly for use with a positioning arm of a disk drive servo writer, said push-pin assembly comprising:

(a) a contact pin comprising:

(i) a contact head comprising an outer surface engageable with a disk drive actuator arm assembly, and

(ii) a shaft comprising a first protrusion spaced from said contact head;

(b) a body interconnectable with the positioning arm, said body comprising a contact pin receptacle, wherein at least a lower portion of said shaft of said contact pin is disposed in said contact pin receptacle such that said body is disposed about a perimeter of said lower portion of said contact pin, and wherein said contact head is disposed beyond an end of said body; and

(c) a vibration damper disposed about a portion of said shaft located between said contact head and said first protrusion.

34. A push-pin assembly, as claimed in Claim 33, wherein said first protrusion of said shaft has an effective diameter larger than an effective diameter of said vibration damper.

35. A push-pin assembly, as claimed in Claim 33, wherein said first protrusion engages a first end surface of said vibration damper.

36. A push-pin assembly, as claimed in Claim 33, wherein said first protrusion comprises a plurality of radially spaced first protrusion segments.

37. A push-pin assembly, as claimed in Claim 33, wherein said first protrusion is annular.

38. A push-pin assembly, as claimed in Claim 33, wherein said first protrusion comprises means for maintaining said contact pin in a set position relative to said body.

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39. A push-pin assembly, as claimed in Claim 33, wherein said shaft further comprises a second protrusion disposed between said contact head and said vibration damper.

40. A push-pin assembly, as claimed in Claim 39, wherein said second protrusion interfaces with an end of said vibration damper, and is free from contact with said body.

41. A push-pin assembly, as claimed in Claim 39, wherein said first protrusion interfaces with a first end of said vibration damper, and said second protrusion interfaces with a second end, opposite said first end, of said vibration damper, and wherein both said first and second protrusions are free from contact with said body.

42. A push-pin assembly, as claimed in Claim 39, wherein said second protrusion comprises a plurality of radially spaced second protrusion segments.

20 43. A push-pin assembly, as claimed in Claim 39, wherein said second protrusion is annular.

44. A push-pin assembly, as claimed in Claim 39, wherein said second protrusion comprises means for preventing contact between said contact head and said body.

45. A push-pin assembly for use with a positioning arm of a disk drive servo writer, said push-pin assembly comprising:

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- (a) a contact pin comprising a shaft and a contact head, wherein said contact head comprises an actuator arm facing surface engageable with a disk drive actuator arm assembly;
 - (b) a body comprising a receptacle wall defining a contact pin receptacle, wherein at least a lower portion of said shaft of said contact pin is disposed in said contact pin receptacle such that at least part of said receptacle wall of said body is disposed about a perimeter of said lower portion of said contact pin, and wherein said contact head is disposed beyond an end of said body; and
 - (c) first and second longitudinally spaced vibration dampers disposed between said lower portion of said shaft of said contact pin and said receptacle wall of said body, wherein at least a portion of said shaft longitudinally oriented between said first and second vibration dampers is separated from said receptacle wall by an open area devoid of vibration dampers.

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46. A push-pin assembly, as claimed in Claim 45, wherein a portion of said shaft of said contact pin opposite said contact head extends beyond an end of both said first and second vibration dampers within said contact pin receptacle.

47. A push-pin assembly, as claimed in Claim 45, wherein said first and second vibration dampers are electrical insulators.

48. A push-pin assembly, as claimed in Claim 47, wherein said lower portion of said shaft comprises a first conductor of a capacitive sensor, said receptacle wall of said body comprises a second conductor of said capacitive sensor, and said open area comprises a dielectric of said capacitive sensor.

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49. A push-pin assembly, as claimed in Claim 45, wherein at least one of said first vibration damper and said second vibration damper is a piezoelectric material.

50. A push-pin assembly, as claimed in Claim 49, wherein said push-pin assembly further comprises means for providing an electrical signal to said piezoelectric material to change at least one physical property of said piezoelectric material.

51. A push-pin assembly, as claimed in Claim 45, wherein said body further comprises a fulcrum on said receptacle wall at a longitudinal position which is between said first and second vibration dampers.

52. A push-pin assembly, as claimed in Claim 45, wherein said push-pin assembly further comprises means for monitoring a position of said shaft of said contact pin relative to said receptacle wall of said body.

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53. A push-pin assembly for use with a positioning arm of a disk drive servo writer, said push-pin assembly comprising:

(a) a contact pin comprising:

(iii) a contact head comprising an outer surface engageable with a disk drive actuator arm assembly, and

(iv) a shaft comprising a protrusion;

(b) a body interconnectable with the positioning arm, said body comprising a contact pin receptacle, wherein at least a lower portion of said shaft of said contact pin is disposed in said contact pin receptacle such that said body is disposed about a perimeter of said lower portion of said contact pin, and wherein said contact head is disposed beyond an end of said body; and

(c) a vibration damper disposed about a portion of said shaft, wherein said protrusion is located between said contact head and said vibration damper.

54. A push-pin assembly, as claimed in Claim 53, wherein said protrusion interfaces with an end of said vibration damper, and is free from contact with said body.

55. A push-pin assembly, as claimed in Claim 53, wherein said protrusion comprises means for preventing contact between said contact head and said body.

56. A push-pin assembly for use with a positioning arm of a disk drive servo writer, said push-pin assembly comprising:

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- (a) a contact pin comprising a shaft and a contact head, wherein said contact head comprises an actuator arm facing surface engageable with a disk drive actuator arm assembly;
- (b) a body interconnectable with the positioning arm, said body comprising a contact pin receptacle defined by a receptacle wall, wherein at least a lower portion of said shaft of said contact pin is disposed in said contact pin receptacle such that said body is disposed about a perimeter of said lower portion of said contact pin, and wherein said contact head is disposed beyond an end of said body;
- (c) first and second vibration dampers disposed in said contact pin receptacle between said shaft and said body; and
- (d) a fulcrum on said receptacle wall of said body, wherein said fulcrum contacts said lower portion of said contact pin, and wherein said fulcrum is disposed between said first and second vibration dampers.

57. A push-pin assembly, as claimed in Claim 56, wherein said fulcrum comprises a plurality of fulcrum segments.

20 58. A push-pin assembly, as claimed in Claim 56, wherein said fulcrum is annular.

59. A push-pin assembly for use with a positioning arm of a disk drive servo writer, said push-pin assembly comprising:

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- (a) a contact pin comprising a shaft and a contact head, wherein said contact head comprises an actuator arm facing surface engageable with a disk drive actuator arm assembly;
- (b) a body interconnectable with the positioning arm, said body comprising a contact pin receptacle, wherein at least a portion of said shaft of said contact pin is disposed in said contact pin receptacle such that said body is disposed about a perimeter of said portion of said contact pin, and wherein said contact head is disposed beyond an end of said body; and
- (c) a vibration damper disposed between said shaft of said contact pin and said body, wherein said ^{protuberance} vibration damper comprises a means for maintaining said contact pin in a set position along a longitudinal extent of said shaft of said contact pin and relative to said body.
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60. A method for executing servo writing operations using a push-pin assembly having a contact pin and a body, wherein a shaft of the contact pin is disposed within a contact pin receptacle of the body, and wherein a vibration damper is disposed between at least a part of the shaft of the contact pin and the body, said method comprising the step of monitoring a condition of the push-pin assembly.

61. A method, as claimed in Claim 60, further comprising the step of detecting a failure of the push-pin assembly in response to said monitoring step.

62. A method, as claimed in Claim 61, further comprising the step of applying a signal to the vibration damper to adjust at least one property of the vibration damper in response to said monitoring step.

63. A method, as claimed in Claim 60, wherein the shaft is a first electrical switch element of an electrical switch, wherein the body is a second electrical switch element of the electrical switch, and wherein said monitoring step comprises determining if said electrical switch is in one of an open condition or a closed condition.

64. A method, as claimed in Claim 63, wherein said monitoring step comprises identifying a failure of the push-pin assembly, wherein the identifying step corresponds with the electrical switch being in the open condition and uses said determining step.

65. A method, as claimed in Claim 63, wherein said monitoring step comprises identifying a failure of the push-pin assembly, wherein the identifying step corresponds with the electrical switch being in the closed condition and uses said determining step.

5 66. A method, as claimed in Claim 60, wherein the body comprises a first conductor of the capacitive sensor, wherein the contact pin comprises a second conductor of the capacitive sensor, and wherein said monitoring step comprises monitoring a capacitance of the capacitive sensor.

67. A method, as claimed in Claim 66, wherein said monitoring step comprises identifying a failure of the push-pin assembly, wherein the failure corresponds with a deviation from a nominal capacitance range.

68. A method, as claimed in Claim 67, further comprising the step of applying an electrical signal to the vibration damper to adjust at least one property of the vibration damper in response to said monitoring step based upon the deviation from the nominal capacitance range.